Radio Science Support

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Since 1967, radio scientists have used the Deep Space Network (DSN) 26- and 64-meter antenna stations to investigate pulsars, to study the effects of solar corona on radio signals, and to observe radio emissions of X-ray sources. Very long baseline interferometry (VLBI) techniques have also been used for high-resolution studies of quasars. Several VLBI observations that were accomplished during the reporting period are summarized.

I. Introduction

The 26- and 64-meter antenna stations of the DSN have been used for several years to support radio science experiments. NASA, JPL, and university scientists have used key DSN facilities whose particular and unique capabilities were required for the performance of the experiments. In order to formalize the method of selecting experiments and experimenters, a Radio Astronomy Experiment Selection (RAES) Panel was formed in 1969. Notice of availability of these facilities was placed in professional journals to inform the scientific community that they were available for limited use by qualified radio scientists (Ref. 1). No charge is made for use of the standard DSN facilities and equipment; special equipment, however, must be provided by the experimenters. A summary of all experiments conducted through April 1971 was reported in Ref. 2.

II. Radio Science Operations

A very long baseline interferometry (VLBI) experiment indicated in the previous report (Ref. 2, page 51) was recently approved, and performed on May 30 and June 25, 1971. The experiment was for the purpose of high-resolution studies of extra-galactic sources at 3 cm and involved simultaneous observations using the 22-meter antenna at the Crimean Astrophysical Observatory (CAO), the 43-meter antenna at the National Radio Astronomy Observatory (NRAO) in Greenbank, West Virginia, and the DSN 64-meter antenna station at Goldstone, California. The USSR experimenters were from CAO and also the Institute for Cosmic Research; the U.S. experimenters are from NRAO, Cornell University, and Caltech. The observations were conducted satisfactorily and the magnetic tapes from the various observatories were taken to NRAO for processing. At Goldstone, experimental equipment in the 8-GHz range was used with a system temperature of about 30 K. At all stations, wideband recording terminals, designated Mark II, were supplied by the NRAO. Timing synchronization between stations was achieved by NRAO personnel flying a rubidium frequency standard from the U.S. station to the CAO via Copenhagen and Leningrad.

Results of the X-band VLBI (8 GHz) measurements made in February 1971 by M. Cohen of Caltech, K. Kellermann and B. Clark of NRAO, and D. Jauncey of Cornell University were submitted for publication in June (Ref. 3). These measurements confirm the milli-second-of-arc structure of 3C279 reported by Shapiro from his measurements in connection with his general relativity experiment (Ref. 4).

In June, Shapiro repeated his measurements using the Goldstone 64-meter station and the MIT Haystack antenna used earlier. The data have been returned to MIT for processing. Further measurements will have to be deferred until the fall of 1971 because the X-band feed cone is being removed from the 64-meter antenna for several months as part of some upgrading and reconfiguration activities.

An observation at S-band at medium bandwidth between the 64-meter antenna at Goldstone and the 26-meter antenna at Woomera, Australia, was made in a continuing series of observations by Australian and Caltech experimenters (Ref. 2).

III. RAES Panel Activities

The RAES Panel approved the repetition of the Goldstone–Haystack observations at X-band. No other new proposals were received during this reporting period.

References

1. *Bulletin of the American Astronomical Society,* Vol. 2, No. 1, p. 177, 1970.
2. Linnes, K. W., Sato, T., and Spitzmesser, D., "Radio Science Support," in *The Deep Space Network Progress Report,* Technical Report 32-1526, Vol. III, pp. 46–51. Jet Propulsion Laboratory, Pasadena, Calif., Jun. 15, 1971.
3. Cohen, M., et al., "The Small Scale Structure of Radio Galaxies and Quasars at 3.8 cm," *Astrophys. J.* (in press).
4. Shapiro, I., et al., "Quasars: Mc/Arc Structure Revealed by Very Long Baseline Interferometry," *Science,* Vol. 172, p. 52, Apr. 2, 1971.